

**Discourse on Method for Reasoning Well
and for Seeking Truth in the Sciences (1637)**
By René Descartes (heavily edited and annotated by David Fenimore)



Historical Note

René Descartes (1596-1650) published *Discourse on Method* in 1637, in Leiden, a university town in the Netherlands where, since it was a Protestant country, the printing presses were not supervised by the Catholic Church. The original edition began with chapters on optics, geometry, and meteorology. The fourth chapter, this *Discourse*, outlined the basis for a new theoretical method of investigating nature and acquiring useful knowledge – what we now call “science.” He later published a more detailed exploration of the philosophical basis for this new approach to science in *Meditations on First Philosophy* (1641).

Biographical Note

Descartes was born to middle-class parents in a small French town that now proudly bears his name. He hated school -- specifically the endless debates and hair-splitting rhetoric that characterized the scholastic Aristotelianism he was taught by his Jesuit teachers, although he did come to appreciate his rigorous training in mathematics. At 22 he had earned a law degree and joined the army, not so much to fight as to see the world. One day in 1619, as he tells the story, the 23-year-old Descartes was sitting in a small stove-heated room in Germany, thinking about how little anybody really knew: could you understand physical nature with the certainty of a mathematical proof? In a blinding and mysterious flash he saw a method for putting all knowledge on solid ground. But he did not immediately work out his ideas; rather, he spent eight years traveling, drinking, gambling and fighting. Then he abandoned all that, moved to Holland so he wouldn't be distracted by the pleasures of France, and spent 20 years in Leiden investigating everything from the philosophy of the scientific method to analytic geometry, physics, optics, human anatomy and other sciences. He postponed publishing much of his work, however, when he learned of Galileo's trial in Rome. When he published this work, the *Discourse*, he became immediately famous, and "schools" of what were called "Cartesians" began to challenge both the entrenched, Aristotelians and also the newfangled "Baconians," disciples of Francis Bacon's empirical method, on the faculties of the European universities. In 1649 Queen Christina of Sweden convinced him to take a position as her private tutor in Stockholm. After an especially cold winter there, he caught pneumonia and died.

(Thanks to Descartes scholar Donald A. Cress for some help with this note. – DF)

Descartes's Own Introduction

If this discourse seems too long to be read in a single sitting, it can be divided up into six parts. In the first will be found various considerations concerning the sciences; in the second, the principal rules of the method which the author has discovered; in the third, some rules of morality which he has derived by this method; in the fourth, the reasons which enable him to establish the existence of God and of the human soul, which are the foundations of his metaphysics; in the fifth part, the order of questions in physics which he has looked into, and particularly the explanation for the movements of the heart and for some other difficulties which are part of medicine, including the difference which exists between our souls and those of animals; in the last part, some matters he believes necessary for further research into nature, beyond where he has been, along with some reasons which have induced him to write.

Part One

Descartes talks about his education and evaluates his early studies with an eye toward throwing most of them away, keeping only what seemed to him to be useful, especially the logic and certainty of mathematics.

... the power of judging well and distinguishing what is true from what is false, which is really what we call good sense or reason, is naturally equal in all men, and thus the difference in our opinions is not because some people are more reasonable than others, but only because we conduct our thoughts in different directions and do not consider the same things. For it is not enough to have a good mind. The main thing is to apply it well. The greatest minds are capable of the greatest vices as well as the greatest virtues, and those who proceed only very slowly, if they always stay on the right road, are capable of advancing a great deal further than those who rush along and wander away from it...

He's skeptical of everything, including his professors and the professions, except for math

... in judging myself, I always try to lean towards the side of distrust rather than to that of belief, and although, when I look with a philosopher's eye on the various actions and enterprises of all men, there are hardly any professions which do not seem to me vain and useless. I cannot help deriving extreme satisfaction from the progress which I think I have already made in my research into the truth and in conceiving such hopes for the future that, if among the occupations of men, simply as men, there is one which is surely good and important, I venture to think it's the one I have chosen.
...

Yet I had been in one of the most famous schools in Europe, a place where I thought there must be wise men, if there were such people anywhere on earth. I had learned everything which the others had learned, but still, not being happy with the sciences which we had been taught, I had gone through all the books which I could lay my hands on dealing with those sciences which are considered the most curious and rare. ...

I found mathematics especially delightful because of the certainty and clarity of its reasoning. But I did not yet notice its true use. Thinking that it was practical only in the mechanical arts, I was astonished that on its foundations, so strong and solid, nothing more imposing had been built up.

I revered our theology and aspired as much as anyone to reach heaven, but having learned, as something very certain, that the road there is no less open to the most ignorant as to the most learned and that the revealed truths which lead there are beyond our intelligence, I did not dare to submit religion to the frailty of my reasoning, ...

The inadequate basis of “philosophy” (meaning the scientific method taught in his time)

I will say nothing of philosophy other than this: once I saw that it had been cultivated for several centuries by the most excellent minds which had ever lived, and that, nonetheless, there was still nothing in it which was not disputed and which was thus not still in doubt, I did not have sufficient presumption to hope to fare better there than the others. Considering how many different opinions, maintained by learned people, philosophy could have about the same matter, without there ever being more than one which could be true, I reckoned as virtually false all those which were merely probable.

Then, as for the other sciences, since they borrow their principles from philosophy, I judged that nothing solid could have been built on such insubstantial foundations; and . . . I already understood . . . not to be taken in either by the promises of an alchemist, by the predictions of an astrologer, by the impostures of a magician, or by the artifice or the bragging of any of those who made a profession of knowing more than they know.

That's why, as soon as my age permitted me to leave the supervision of my professors, I left the university, and, resolving not to look any more in any other science except one which could be found inside myself or in the great book of the world, I spent the rest of my youth traveling, looking into courts and armies, associating with people of various humors and conditions, collecting various experiences, testing myself in the encounters which fortune offered me, and everywhere reflecting on the things I came across from which I could to draw some profit. ...

Part Two

Descartes sits alone in a little room and considers why he needs to discard all the useless rhetoric of university studies, by starting from the beginning and applying the rigors of mathematical proof to discovering the principles behind natural phenomena, creating an entirely new system of knowledge from scratch. Knowing that science must be based on philosophy, he invents an objective philosophy focused on mathematical logic and measurement, rather than on words or on observations of the natural world.



**Statue of Descartes in front of the
Town Hall in Descartes, France (his
birthplace, later re-named after him)**

I was then in Germany, summoned there by the wars which have not yet concluded. As I was returning to the army from the coronation of the emperor, the onset of winter stopped me in quarters where, not finding any conversation to divert me and, by good fortune, not having any cares or passions to trouble me, I spent the entire day closed up alone in a room heated by a stove, where I had all the leisure to talk to myself about my thoughts. ...

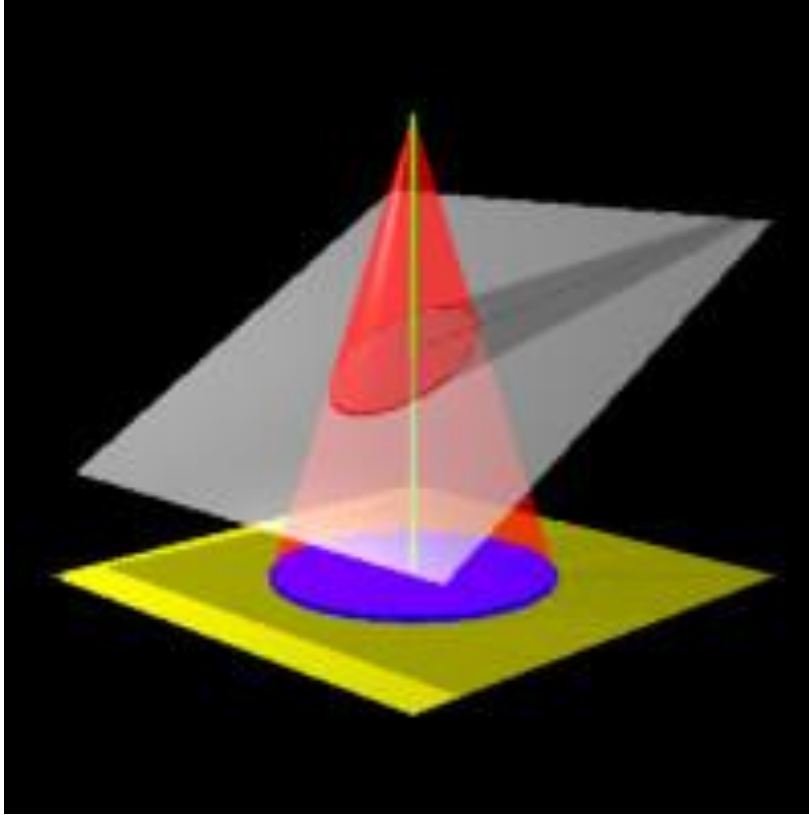
He decides to base his life and his further study on the principles of geometry

When I was younger, among the branches of philosophy, I had studied a little logic. . . , geometrical analysis and algebra, three arts or sciences which looked as if they ought to contribute something to my project. ... I thought I had to look for some other method which included the advantages of these three subjects but was free of their defects. And since a multitude of laws often provides excuses for vices, so that a state is much better ruled when it has only a very few laws which are very strictly observed, I thought that, instead of that large number of rules which make up logic, I would have enough with the four following rules, provided that I maintained a strong and constant resolution that I would never fail to observe them, not even once.

1. The first rule was that I would not accept anything as true which I did not clearly know to be true. That is to say, I would carefully avoid being over hasty or prejudiced, and I would understand nothing by my judgments beyond what presented itself so clearly and distinctly to my mind that I could not doubt it.
2. The second was to divide each problem which I examined into as many parts as possible and as might be necessary to resolve it better.
3. The third was to conduct my thoughts in an orderly way, beginning with the simplest objects, the ones easiest to know, so that little by little I could gradually climb right up to the knowledge of the most complex, by assuming the same order, even among those things which do not naturally come one after the other.
4. And the last was to make my calculations throughout so complete and my examinations so general that I would be confident of not omitting anything.

Those long chains of reasons, all simple and easy, which geometers have habitually used to reach the most difficult proofs, gave me occasion to imagine to myself that everything which could fall under human knowledge would follow in the same way and that, provided only that one refused to accept anything as true which was not and that one always kept to the order necessary to deduce one thing from another, there would not be anything so far distant that one could not finally reach it, nor so hidden that one could not discover it. ...

When I thought about how, among all those who had so far searched for truth in the sciences, it was only the mathematicians who had been able to find some proofs, that is to say, some certain and evident reasons, I had no doubt at all that I should start with the same things which they had examined, although I did not hope for any practical results, other than that they would accustom my mind to reveling in the truth and not to remain happy with false reasons. ... they could be all the better applied later to every other subject for which they might be suitable. ... I would borrow all the best elements of analytic geometry and algebra and correct all the defects of one by the other.



As part of his search for eternal truth, Descartes invents analytical geometry, and, as if that wasn't enough, superscripted numbers to represent exponential quantities!

Using this method, not only did I resolve several problems which I had previously judged very difficult, but it also seemed to me towards the end that I could determine, even with those questions where I was ignorant, the way to resolve them and the extent to which such resolution was possible. In saying this, perhaps I will not appear too vain if you consider that, since there is only one truth for each thing, whoever finds it knows as much as one can know about it and that, for example, a child instructed in arithmetic, having made an addition following the rules, can be confident of having found, so far as the sum he is examining is concerned, everything that the human mind can find out. For the method which teaches one to follow the true order and to count exactly all the relevant details in what one is looking for contains everything which gives certainty to the rules of arithmetic.

But what pleased me the most with this method was that with it I was confident of using all my reason, if not perfectly, at least as well as was in my power. In addition, I felt, as I applied it, that my mind was accustoming itself gradually to think more clearly and distinctly about its objects, and because I had not restricted this method to one matter in particular, I was hopeful that I could apply it just as usefully to difficulties in the other sciences as I had applied it to those in algebra.

Since any search for truth needs to be based on a philosophical theory (i.e., an answer to the question “what is truth”) he decides to develop a new foundation for his new method

But for all that, I did not venture to try immediately examining all those scientific problems which presented themselves. For that would have been contrary to the order which my method prescribed. But I noticed that the principles of science all had to be borrowed from philosophy, a subject in which I no longer found anything certain. So I thought that, before anything else, I should attempt to establish such principles and that, since this was the most important matter in the world, where

one had to be most fearful of over-hasty and biased judgments, I would not try to get through it until I had reached an age considerably more mature than I was then at twenty-three and until I had used a lot more time preparing myself, weeding out of my mind all the bad opinions which I had accepted before that time, as well as collecting experiences which later could be the subject matter of my reasoning, always practicing the method which I had set for myself in order to keep improving myself in these matters.

Part Three

Suppressing his emotions and his appetites, he adopts a Stoical code of behavior that denies the importance of the body and prepares him for a disciplined and objective pursuit of knowledge in the sciences. He withdraws from the world of action and affairs to the university town of Leiden, in the Netherlands, which is under martial law and so promises him a refuge from the constant wars racking Europe at the time.



Descartes's little room was near here in the lovely university town of Leiden, Netherlands.

... in order to be able to live from then on as happily as I could, I drew up for myself a provisional morality: to be as constant and as resolute in my actions as I could, and to follow the most doubtful opinions, once I had settled on them for myself, with no less constancy than if they had been very sure, imitating in this matter travelers who, finding themselves lost in some forest, should not

wander around, shifting direction this way and that; even less should they stop in one place; they should move on always as straight as they can in the same direction and not change it for inadequate reasons, even though at the beginning it was perhaps only chance which led to their choice of direction. For in this way, if they do not come out exactly where they want to, they will at least end up arriving somewhere where they will probably be better than in the middle of a forest. . . .

I also resolved to try always to overcome myself rather than fortune and to change my desires rather than the order of the world, and generally to get in the habit of believing that there is nothing which is entirely within our power except our thoughts, so that after we have done our best concerning those things which lie outside of us, everything which our attempt fails to deal with is, so far as we are concerned, absolutely impossible.

Part Four

Here he explains his method of mapping the physical universe with mathematics, rather than with words, pictures, or data sets. In other words, he rejects the validity of information received through the senses as no better than dreams. Instead, he argues for a completely rational process, abstracting nature into a series of numerical relationships, and using geometry to model reality. The foundation of this approach is laid by rejecting the provable existence of everything physical, including his body and the entire material world. Taking a stand on what remains, he affirms the ultimate reality of his thought processes and, by extension, the existence of God as the only perfect idea. He then proceeds to construct a mental map of the universe, organized into a grid of x-y-z coordinates and operating by mathematical laws whose regularity and dependability he guarantees by the existence of God.

What we see, hear, smell etc. is unreliable information, so subjective as to be useless

. . . because our senses deceive us sometimes, I was willing to assume that there was nothing which existed the way our senses present it to us. . . . and because I judged that I was subject to error just as much as anyone else, I rejected as false all the reasons which I had taken earlier as proofs. Finally, considering that all the same thoughts which we have when awake can also come to us when we are asleep, without there being truth in any of them at the time, I determined to pretend that everything which had ever entered my mind was no more real than the illusions of my dreams.

The only thing you can't doubt is that you are doubting; you can't pretend you are not thinking

But immediately afterwards I noticed that, while I wished in this way to think everything was false, it was necessary that I—who was doing the thinking—had to be something. Noticing that this truth—I think, therefore I am—was so firm and so sure that all the most extravagant assumptions of the skeptics would not be able to weaken it, I judged that I could accept it without reservations as the first principle of the philosophy I was looking for.

. . . I saw that I could pretend that I had no body and that the world and the place where I was did not exist, but that, in spite of this, I could not pretend that I did not exist. By contrast, in the very act of thinking about doubting the truth of other things, it very clearly and certainly followed that I existed; whereas, if I had once stopped thinking, even though all the other things which I had imagined were real, I would have no reason to believe that I existed. From that I recognized that I

was a substance whose essence or nature is only thinking, a substance which had no need of any location and did not depend on any material thing, so that this "I," that is to say, the soul, by which I am what I am, is entirely distinct from the body and is even easier to know than the body, and that, even if the body were no longer there, the soul could not help being everything it is.

After that, I considered in general what is necessary for a proposition to be true and certain, for since I had just found one idea which I knew to be true and certain, I thought that I ought also to understand what this certitude consisted of. And having noticed that in the sentence "*I think; therefore, I am*" there is nothing at all to assure me that I am speaking the truth, other than that I see very clearly that in order to think it is necessary to exist, I judged that I could take as a general rule the point that the things which we conceive very clearly and very distinctly are all true. But that left the single difficulty of properly noticing which things are the ones we conceive distinctly.

After that, I reflected on the fact that I had doubts and that, as a result, my being was not completely perfect, for I saw clearly that it was a greater perfection to know than to doubt. I realized that I should seek out where I had learned to think of something more perfect than I was. And I concluded that obviously this must be something with a nature which was, in effect, more perfect.

As for the thoughts which I had of several other things outside of me, like the sky, the earth, light, heat, and a thousand others, I was not worried about knowing where they came from, because I didn't notice anything in them which seemed to me to make them superior to myself. Thus, I was able to think that, if they were true, that was because of their dependence on my nature, in so far as they had some perfection and, if they were not true, I held them from nothing, that is to say, that they were in me because I had some defect.

The perfection of the thought process (if conducted correctly) depends on the existence of perfection, i.e. the existence of a perfect being: "God"

But that could not be the same with the idea of a being more perfect than mine. For to hold that idea from nothing would be manifestly impossible. And because it is no less unacceptable that something more perfect should be a consequence of and dependent on something less perfect than that something should come from nothing, I could not derive this idea from myself. Thus, I concluded that the idea had been put in me by a nature which was truly more perfect than I was, even one which contained in itself all the perfections about which I could have some idea, that is to say, to explain myself in a single phrase, a nature which was God.

To this I added the fact that, since I know about some perfections which I do not have, I was not the only being which existed. ... But it must of necessity be the case that there was some other more perfect being, on whom I depended and from whom I had acquired all that I had. For if I had been alone and independent of everything else, so that I derived every idea, however little, which I shared of the perfect being from myself, I would have been able to have from myself, for the same reason, all the additional perfections which I knew I lacked, and thus be myself infinite, eternal, immutable, all knowing, all powerful, and finally have all the perfections which I could observe as present in God.

For, following the reasoning which I have just made, to know the nature of God, to the extent that my reasoning is able to do that, I only had to think about of all the things of which I had some idea within me and consider whether it was a sign of perfection to possess them or not. And I was

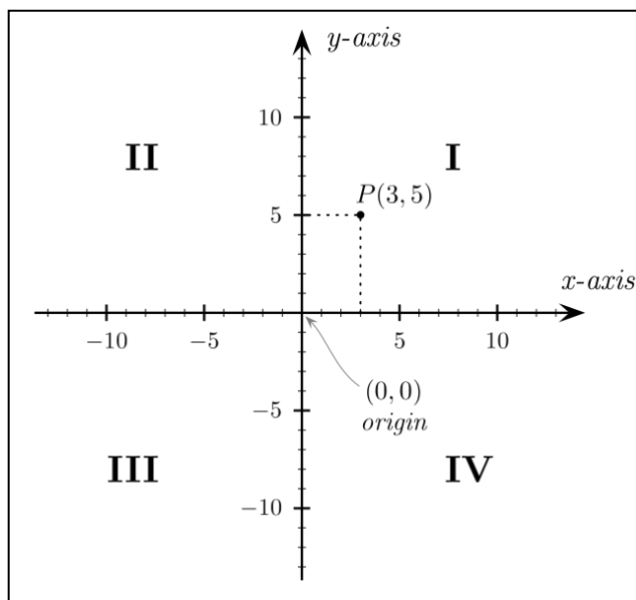
confident that none of those ideas which indicated some imperfection were in God, but that all the others were there, since I perceived that doubt, inconstancy, sadness, and similar things could not be in God, in view of the fact that I myself would have been very pleased to be free of them.

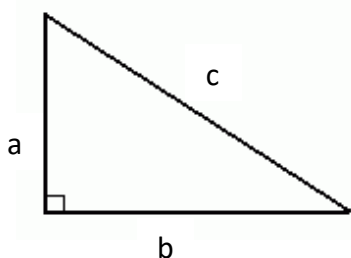
Then, in addition, I had ideas about several sensible and corporeal things. For although I supposed that I was asleep and that everything which I saw or imagined was false, nonetheless I could not deny that the ideas had truly been in my thoughts. But because I had already recognized in me very clearly that intelligent nature is distinct from corporeal nature, when I considered that all composite natures indicate dependency and that dependency is manifestly a defect, I judged from this that God's perfection could not consist of being composed of two natures, and that thus He was not, but that if there were some bodies in the world or even some intelligences or other natures which were not completely perfect, their being had to depend on God's power, in such a way as they could not subsist for a single moment without Him.

In order to describe the material world using only rational, mathematical means, Descartes invents what we now call after him "Cartesian coordinates," which assume that any point in the universe can be described by three numbers.

The only way Descartes can be sure he is thinking clearly ("perfectly") about the world is to describe it mathematically

After that I wanted to look for other truths, and I proposed to myself the subject matter of geometers, which I understood as a continuous body or a space extended indefinitely in length, width, and height or depth, divisible into various parts, which could have various figures and sizes and be moved or transposed in all sorts of ways, for the geometers assume all that in their subject matter. I glanced through some of their simplest proofs, and having observed that this grand certainty which all the world attributes to them is founded only on the fact that they plan these proofs clearly, following the rule which I have so often stated, I notice also that there is nothing at all in their proofs which assures me of the existence of their objects. So, for example, I do see that, if we assume a triangle, it must be the case that its three angles are equal to two right angles, but, in spite of that, I don't see anything which assures me that there is a triangle in the world. But, by contrast, once I returned to an examination of the idea which I had of a perfect being, I found that that being contains the idea of existence in the same way as the fact the three angles of a triangle are equal to two right angles is contained in the idea of a triangle, or that in a sphere all the parts are equidistant from the center, or something even more evident, and that, as a result, it is at just as certain that God, this perfect being, is or exists as any geometric proof can be.





Descartes argues that the Pythagorean theorem ($a^2+b^2=c^2$), and all the other theorems of geometry and mathematics in general, are perfect and eternal because they are reflections of the perfection of God.

He rejects the evidence of the senses as unreliable compared to rational thought

... the philosophers in the universities maintain the axiom that there is nothing in the understanding which has not first of all been in the senses. But it is certain that the ideas of God and the soul have never been present in sense experience. It seemed to me that those who want to use their senses to find truth are acting just as if they want to use their eyes to hear sounds or smell odors, except that there is still this difference, that the sense of sight provides us no less assurance of the truth of what it sees than do the sense of smell or hearing; whereas, neither our imagination nor our senses can assure us of anything unless our understanding intercedes.

For Descartes, our conscious, thinking self – our “soul” – is an immaterial, spiritual, immortal thing located in the brain and entirely separate from the physical body. This self “knows” things by rational thought processes, not through senses or feelings



Finally, if there are still some people who are insufficiently persuaded of the existence of God and their soul by the reasons I have provided, I'd like them to know that everything else which they are more confident about, like having a body and knowing that there are stars and an earth, and things like that, are less certain than God's existence. For although one has a moral assurance about these things, something which makes doubting them appear at least extravagant, nonetheless it also seems at least unreasonable, when a question of metaphysical certainty is involved, for someone to deny that there is sufficient material here to make one not completely confident, for we notice that one can imagine in the same way while sleeping that one has a body and that one sees other stars and another earth, without such things existing.

For what is the source of our knowledge that the thoughts which come while dreaming are false, rather than the others, seeing that often they are no less lively and distinct? And if the best minds study this matter as much as they please, I do not think that they will be able to give any reason

which will be sufficient to remove this doubt unless they presuppose the existence of God. First of all, the very principle which I have so often taken as a rule—only to recognize as true all those things which we conceive very clearly and very distinctly—is guaranteed only because of the fact that God is or exists, that He is a perfect being, and that everything which is in us comes from Him. From that it follows that our ideas or notions, being real things which come from God, to the extent that they are clear and distinct, in that respect cannot be anything but true. Consequently, if we often enough have some ideas or notions which contain something false, that can only be those which contain some confusion and obscurity, because we are not completely perfect.

And evidently it is no less repugnant that falsity or imperfection, in itself, should come from God than that utility or truth should come from nothingness. But if we did not know that everything real and true within us came from a perfect and infinite being, then no matter how clear and distinct our ideas were, we would not have a single reason to assure us that they had the perfection of being true.

Now, after the knowledge of God and the soul in this way has made us certain of this rule, it is really easy to see that the dreams which we imagine while asleep should not, in any way, make us doubt the truth of the thoughts we have while awake. For if it happened, even while we were sleeping, that we had some really distinct idea, as, for example, in the case of a geometer inventing some new proof, the fact that he is asleep does not prevent it from being true, and as for error, it doesn't matter that the most common dreams we have, which consist of representing to us various objects in the same way as our external senses do, can give us occasion to challenge the truth of such ideas, because these ideas can also mislead us often enough without our being asleep, as, for example, when those people suffering from jaundice see all objects as yellow, or when the stars or other bodies at a great distant appear to us much smaller than they are.

Rational thought is therefore superior to sensory information, or feelings

For, finally, whether we are awake or asleep, we should never allow ourselves to be persuaded except by the evidence of our reason. And people should note that I say of our reason and not of our imagination or of our senses, since even though we see the sun very clearly, we should not for that reason judge that it is only the size which we see, and we can easily imagine distinctly the head of a lion mounted on the body of goat, without having to conclude, because of that, there is a chimeraⁱ in the world: for reason does not dictate to us that what we see or imagine in this way is true, but it does dictate to us that all our ideas or notions must have some foundation in truth, for it would not be possible that God, who is completely perfect and totally truthful, put them in us without that. Because our reasoning is never so evident or complete during sleeping as while we are awake, although then sometimes our imaginations are as vital or explicit, or more so, reason also dictates to us that our ideas cannot all be true, because we are not completely perfect—those which contain the truth must without exception come in those we experience while awake rather than in those we have while asleep.

Part Five

He summarizes the contents of his work on light (attached to the original edition of this Discourse), and argues that while natural law may not be the way God created the world, these universal physical laws are sufficient to bring it into being from chaos. He cites recent medical research to show that the human body is only a machine like an animal's, governed by the laws of the material world, and so whatever makes us human is spiritual, not physical in nature. Therefore the creation of thinking

robots [artificial consciousness] is impossible, just as animals cannot speak or have souls.

I would be very pleased to continue and make you see here all the chain of other truths which I deduced from these first ones. But because that would require that I talked of several questions which are controversial among scholars, things I do not want to get mixed up with, I think it would be better to refrain from that and speak only in general about what these matters are, so that the more learned can judge if it would be useful for the public to be informed about more particular details.

I always lived firm in the resolution that I had taken not to assume any other principle than the one which I have just used to demonstrate the existence of God and the soul, and to accept nothing as true which did not seem to me more clear and more certain than the proofs of geometry had seemed to me previously. Nonetheless, I venture to say that, not only did I find a way of satisfying myself in a short time concerning all the difficult principles which people are accustomed to deal with in philosophy, but also I noticed certain laws which God has established in nature. Since He has imprinted ideas of these laws in our souls, after we have reflected on them sufficiently, we cannot doubt that they are precisely observed in everything which exists or which acts in the world. Then, as I considered the consequence of these laws, it seemed to me that I had discovered several truths more useful and more important than everything which I had previously learned or even hoped to learn.

This discourse only summarizes everything he has learned about how the universe works

But since I attempted to explain the principles in a treatise which certain considerationsⁱⁱ prevented me from publishing, I do not know how better to make them known than stating here in summary form what that treatise contains. Before writing that text, I had the intention of including in it all that I thought I knew concerning the nature of material things. But just as painters cannot portray equally well in a flat picture all the various surfaces of a solid body and choose one of the main surfaces, which they set by itself facing the light and, by placing the others in shadows, do not show anything more than one can see by looking at them, in the same way, fearing that I could not put in my discourse everything I had in my thoughts, I tried only to reveal there fairly fully what I understood about light, and then at the appropriate time, to add something about the sun and the fixed stars, because almost all light comes from them, about the heavens, because they transmit light; about the planets, comets, and the earth, because they reflect light, and in particular about all the bodies on earth, because they are colored, or transparent, or luminous, and finally about man, because he is the one who looks at these things.

To protect himself from arguments with the authorities, he claims he is describing an “imaginary” world where the only forces in operation are natural, physical laws

Even so, in order to shade in all these things a little and to be able to speak more freely of what I was judging, without being obliged to follow or to refute received opinions among the learned, I resolved to leave everyone here to their disputes and to speak only of what would happen in a new world, if God now created somewhere in imaginary space enough material to compose it, and if He set in motion, in a varied and disorderly way, the various parts of this material, so that it created a chaos as confused as poets could make it, and then afterwards He did nothing other than lend His ordinary help to nature and allow it to act according to the laws which He established.

So first of all I described this material and tried to picture it in such a way that there is nothing in the

world, it seems to me, clearer and more intelligible, except what has been said from time to time about God and the soul. For I even explicitly assumed that in the world there were none of those forms or qualities which people argue about in the universities, nor, in general, anything the knowledge of which was not so natural to our souls that we could not even pretend to remain ignorant of it.

In addition, I made known the laws of nature, and without basing my reasoning on any principle other than the infinite perfections of God, I tried to demonstrate all of these laws about which one could entertain any doubts, to show that they are such that, although God could have created several worlds, there would not be one where these failed to be observed. After that, I showed how the greatest part of material in chaos would have to, as a result of these laws, organize and arrange itself in a certain way which made it similar to our heavens, how, in so doing, some of its parts must have made up an earth and some parts planets and comets, and some other parts a sun and fixed stars.

Descartes argues here that the “laws” (meaning the laws of physics, or natural laws) are as eternal and perfect as God. This means for him that these natural laws don’t just apply on Earth, but that they are universal and govern everything in the universe that has been and will be created, bringing order out of chaos and shaping primordial matter into stars and planets. (For many people, this claim raised the question of who is more powerful: the laws of nature, or God? Could God change the speed of light, for example, or the gravitational constant?)

And at this point, dwelling on the subject of light, I explained at some length the nature of light which must be found in the sun and the stars, how from there it crossed in an instant the immense distances of heavenly space, and how it is reflected from the planets and comets towards the earth. To this I added several things concerning the material, the arrangement, the movements, and all the various qualities of our heavens and the stars. Consequently, I thought I had said enough about these matters to make known the fact that one observes nothing in these features of this world which must not, or at least could not, appear entirely similar to those of the world which I described.

From there I went on to speak in particular about the earth, about how, although I had expressly assumed that God had placed no heaviness in the material of which it is composed, all its parts could not help tending to move precisely to its center, how, having water and air on its surface, the arrangement of the heavens and the stars, and particularly of the moon, had to create on earth an ebb and flow similar in all its features to the ones we see in our oceans, and, beyond that, a certain flow in the water as well as in the air, from east to west, like the one we observe between the tropics, how the mountains, seas, fountains, and rivers can naturally form out of that, how earth's metals come into the mines, and how the plants on earth grow in the fields, and, in general, how all the things we call mixed or composite could be produced on earth.

And, among other things, because there is nothing on earth which produces light except fire (other than the stars), I studied to understand clearly everything associated with the nature of fire, how it arises, how it is nourished, how sometimes it has heat without light and sometimes light without heat, how it can introduce various colors in different bodies, as well as various other qualities, how it melts some things and makes others harder, how it can consume almost everything or convert it into

ash and smoke, and finally how, out of these cinders, simply by the violence of its actions, it makes glass. For this transformation of cinders into glass seemed to be as wonderful as anything else which happens in nature, and I took particular pleasure in describing it.

In an amusing (to us) bit of double-talk, Descartes admits that the traditional creation story is more “probable,” but also points out that many religious authorities agree that God created the physical laws, through the operation of which the world was created

However, I don't want to suggest from all these things that this world was created in the fashion which I was proposing. For it is much more probable that God made the world from the beginning just what it had to be. But it is certain, and this is an opinion commonly received among theologians, that the actions by which God now preserves the world are exactly the same as the method by which He created it, in such a way that even if He did not give it at the start any form other than a chaos, providing that He had first established the laws of nature and had given His assistance, so that it would act as it usually does, we can believe, without denying the miracle of creation, that because of these facts all purely material things would have been able, over time, to become the way we now observe them, and their nature is much easier to conceive when one sees them born gradually in this way than if one thinks of them only as made all at once.

Here Descartes voices a kind of Big Bang theory and even imagines something like evolutionary theory, arguing that, like a machine, the universe and everything in it took shape over time as a result of the workings of the laws of physics, rather than suddenly being created out of nothing. (Although, notice how he hedges a little bit, as if unwilling to let his science conflict with religious dogma, or at least careful not to give that impression.)

From the description of the inanimate bodies and of plants, I moved onto the bodies of animals and especially the body of man.



“Vitruvian Man,” a 1490 drawing by Leonardo da Vinci meant to illustrate the geometrical perfection of the human body

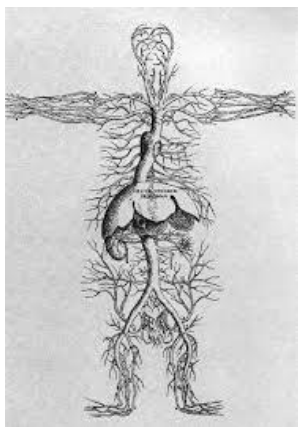
But because I did not yet have sufficient knowledge to speak of that in the same way as of other things, that is to say, to speak of effects in terms of causes, by revealing the seeds and the methods by which nature had to produce them, I contented myself with assuming that God formed the human body completely like one of our own, both the external shape of its limbs and the arrangement of its inner organs, without making them of any material other than the one which I

had described and without, at the start, placing in that body any reasonable soul or any other thing to serve the body as a vegetative or sensitive soul, except that He kindled in its heart one of those fires without light which I had already explained and which I conceived as in no way different in its nature from the fire which heats hay when it is closed up in a sack or which makes new wines bubble when they are allowed to ferment after crushing.

He assumes that the bodies of humans were created in the same mechanical way that animal bodies were created, the only difference being that humans were given souls

For, by examining the functions which, as a result of this assumption, could be present in this body, I found precisely all those which could be in us without our thinking about them, and thus without any contribution from our soul, that is to say, the distinct part of the body whose nature is solely to think (as I have said above), the functions which we can say are all those in which the animals without reason are similar to us. But in doing this, I could not find any of those which, because they are dependent on thought, are the only ones which pertain to us, as men; whereas, I found all of them afterwards, once I assumed the God had created a reasonable soul and joined it to this body in the particular way which I described.

This is a restatement of what he has written earlier: that the body and the soul are completely separate. Like the rest of the physical universe, the body is a machine that runs, in this case, on chemical energy (which he compares above to the heat of fermentation). Human bodies are no different from those of animals, and the soul is an immaterial, thinking (“reasonable”) and immortal spirit joined to that material human body.



But so that you can see how I dealt with this material, I want to put in here the explanation for the movement of the heart and the arteries, the first and the most universal thing which one observes in animals. From that one will easily assess what one should think of all the others. And so that people have less difficulty understanding what I am going to say, I would like those who are not versed in anatomy to take the trouble, before reading this, to have the heart of some large animal with lungs dissected in front of them. For it is in all respects quite similar to the heart in man. And I would like them to have demonstrated to them the two chambers or cavities which are in that heart.

Descartes is giving a shout-out here to early English medical researcher William Harvey (1578-1667), first to demonstrate the circulatory system. For Descartes, this discovery suggests that the human body, and all living bodies, are nothing more than machines – “this body [is] a machine ... made by God” (17) – and so can be engineered, built, repaired, and made to look exactly like a living being (except without a “soul”)

First, there is one chamber on its right side, to which two very large tubes are attached, that is, the *vena cava*, which is the principal receptacle of blood, as it were, the trunk of the tree of which all the other veins of the body are the branches, and the *vena arteriosa*ⁱⁱⁱ, which has, with that label, been

poorly named, because it is, in fact, an artery, the one which, originating at the heart, divides up into several branches, which go out to distribute themselves throughout the lungs. Then there is the chamber on the left side of the heart, to which, in the same way, two tubes are attached, which are as large or larger than the ones just mentioned: that is, the venous artery, a vein which comes from the lungs, where it is divided into several branches interwoven with those from the arterial vein and with those associated with the tube called the windpipe, through which air enters for respiration; and the large artery which, leaving the heart, sends its branches throughout the body.

There is nothing magical about the heart; it is merely a machine, like a clock

... blood flows from the *vena cava* into the right chamber and from the venous artery into the left, because these two blood vessels are always full and their openings, which are oriented towards the heart, cannot then be blocked... this movement is necessarily a result of the mere arrangement of the organs which one can see in the heart with one's own eyes and of the heat which one can feel there with one's fingers and of the nature of blood which one can recognize from experience, as the movement of a clock is necessarily a result of the force, the placement, and the shape of its counterweights and wheels.

... there's no need for me to say anything more other than what has already been written by an English doctor^{iv}, to whom we must give the honor of having broken the ice in this area and of being the first to teach that there are several small passages at the extremities of the arteries through which the blood which they receive from the heart enters into the small branches of the veins, from where it proceeds to move once again towards the heart, so that its passage is nothing other than a constant circulation. ...

The human body, no different than animal bodies, is a machine that moves automatically

I explained in particular detail all these things in the treatise which I had planned to publish previously. And then I demonstrated what the nerves and muscles in the human body were made of, so that the animal spirits, once inside the nerves, would have the power to move its limbs, as one sees that heads, for a little while after being cut off, continue to move and bite the earth, in spite of the fact that they are no longer animated. I also showed what changes must take place in the brain to cause the waking state, sleep, and dreams, how light, sounds, smells, tastes, heat, and all the other qualities of external objects could imprint various ideas on the brain through the mediation of the senses, just as hunger, thirst, and the other inner passions can also send their ideas to the brain; which of them must be taken there for common sense and where these ideas are taken in, for memory which preserves them, and for fantasy which can change them in various ways and compose new ones, and, in the same way, distribute animal spirits to the muscles and make the limbs of the body move in all the different ways—in relation to the objects which present themselves to the senses and in relation to the interior physical passions—our bodies can move themselves without being led by the will.

None of this will seem strange to those who know how many varieties of automata, or moving machines, human industry can make, by using only very few pieces in comparison with the huge number of bones, muscles, nerves, arteries, veins, and all the other parts in the body of each animal. They will look on this body as a machine, which, having been made by the hand of God, is incomparably better ordered and more inherently admirable in its movements than any of those which human beings could have invented.

And here, in particular, I stopped to reveal that if there were machines which had the organs and the external shape of a monkey or of some other animal without reason, we would have no way of recognizing that they were not exactly the same nature as the animals; whereas, if there was a machine shaped like our bodies which imitated our actions as much as is morally possible, we would always have two very certain ways of recognizing that they were not, for all their resemblance, true human beings.



Here Descartes proposes an early version of the “Turing Test,” proposed by computer scientist Alan Turing in the mid-20th century, to distinguish a robot from a human.

Robin Williams, in Bicentennial Man (1999)

First test: using language to hold a conversation

The first of these is that they would never be able to use words or other signs to make words as we do to declare our thoughts to others: for one can easily imagine a machine made in such a way that it expresses words, even that it expresses some words relevant to some physical actions which bring about some change in its organs (for example, if one touches it in some spot, the machine asks what it is that one wants to say to it; if in another spot, it cries that one has hurt it, and things like that), but one cannot imagine a machine that arranges words in various ways to reply to the sense of everything said in its presence, as the most stupid human beings are capable of doing.

Second test: versatility in thought and action

The second test is that, although these machines might do several things as well or perhaps better than we do, they are inevitably lacking in some other, through which we discover that they act, not by knowledge, but only by the arrangement of their organs. For, whereas reason is a universal instrument which can serve in all sorts of encounters, these organs need some particular arrangement for each particular action. As a result of that, it is morally impossible that there is in a machine's organs sufficient variety to act in all the events of our lives in the same way that our reason empowers us to act.

Animals do not use language like humans

Now, by these two same means, one can also recognize the difference between human beings and animals. For there are no men so dull and stupid, including even idiots, who are not capable of putting together different words and of creating out of them a conversation through which they make their thoughts known; by contrast, there is no other animal, no matter how perfect and how successful it might be, which can do anything like that. And this inability does not come about from a lack of organs. For we see that magpies and parrots can emit words, as we can, but nonetheless cannot talk like us, that is to say, giving evidence that they are thinking about what they are uttering;

whereas, men who are born deaf and dumb are deprived of organs which other people use to speak—just as much as or more than the animals—but they have a habit of inventing on their own some signs by which they can make themselves understood to those who, being usually with them, have the spare time to learn their language.

Animals, unlike humans, have no soul attached to their body and so are *only* machines

... animals have less reason than men, [in fact] none at all. For we see that it takes very little for someone to learn how to speak, and since we observe inequality among the animals of the same species just as much as among human beings, and see that some are easier to train than others, it would be incredible that a monkey or a parrot which is the most perfect of his species was not equivalent in speaking to the most stupid child or at least a child with a troubled brain, unless their soul had a nature totally different from our own. And one should not confuse words with natural movement which attest to the passions and can be imitated by machines as well as by animals, nor should one think, like some ancients, that animals talk, although we do not understand their language. For if that were true, because they have several organs related to our own, they could just as easily make themselves understood to us as to the animals like them.

For Descartes, animals were nothing more than machines, like a human body but with no eternal soul or capacity for logical thought or language. Today, we know that many animals use language and even reason.



Another truly remarkable thing is that, although there are several animals which display more industry in some of their actions than we do, we nonetheless see that they do not display that at all in many other actions. Thus, the fact that they do better than we do does not prove that they have a mind, for, if that were the case, they would have more of it than any of us and would do better in all other things; it rather shows that they have no reason at all, and that it's nature which has activated them according to the arrangement of their organs—just as one sees that a clock, which is composed only of wheels and springs, can keep track of the hours and measure time more accurately than we can, for all our care.

The immaterial soul is completely separate from the material body, though connected to it

After that, I described the reasonable soul and revealed that it cannot be inferred in any way from the power of matter, like the other things I have spoken about, but that it must be expressly created, and I described how it is not sufficient that it is lodged in the human body like a pilot in his ship, perhaps simply to move its limbs, but that it is necessary that the soul is joined and united more closely with the body, so that it has, in addition, feelings and appetites similar to ours and thus makes up a true human being.

As for the rest, here I went on at some length on the subject of the soul, because it is among the most important. For, apart from the error of those who deny God, which I believe I have adequately refuted above, there is nothing which distances feeble minds from the right road of virtue more readily than to imagine that the soul of animals is the same nature as our own and that thus we have

nothing either to fear or to hope for after this life, any more than flies and ants do; whereas, once one knows how different they are, one understands much better the reasons which prove that the nature of our souls is totally independent of the body, and thus it is not at all subject to dying along with the body. Then, to the extent that one cannot see other causes which destroy the soul, one is naturally led to judge that the soul is immortal.

Part Six

Galileo's 1633 trial is cited as an excuse why he won't go into more detail about his research, but Descartes argues that, from these principles, all the laws of the physical universe can be deduced, and by following these laws humans can become "masters and possessors of nature," inventing and using machines to ease the burden of existence and conquering disease and possibly even death itself. He expresses his hopes for the generations that follow him [including us!] and apologizes for writing in French, the everyday language of the people, and not in Latin, the language of the scholarship, universities, and the Church.

It is now three years since I reached the end of the treatise which contains all these things and since I started to revise it in order to put it into the hands of a printer. Then I learned that people to whom I defer and whose authority over my actions could hardly be less than my own reason over my thoughts expressed disapproval of an opinion about physics published a little earlier by someone else^v. I don't wish to say that I subscribed to that opinion, but, although I had observed nothing before their censure which I could imagine prejudicial to religion or the state, and thus nothing which would have prevented me from writing if reason persuaded me, after that I was nevertheless afraid that there might be something among my opinions where I had gone astray, notwithstanding the great care I always took not to accept new ideas into my beliefs for which I did not have very certain proofs and not to write anything which would work to anyone's disadvantage. This was sufficient to oblige me to alter my resolution to publish my opinions. For although the reasons I had adopted earlier had been very strong, my inclination, which has always led me to hate the profession of producing books, made me immediately find enough other reasons to excuse myself in this matter. And, given the nature of these reasons, on one side or the other, I'm quite interested, not only in stating them here, but also in the possibility that the public may learn something about them. . . .

Although he worries about offending the Church, he decides to publish because it is his moral duty to share this method, which will benefit humankind

But immediately after I had acquired some general notions concerning physics and, by starting to test them on various particular difficulties, had noticed just where they could lead and how much they differed from principles which people have used up to the present time, I thought that I could not keep them hidden without sinning greatly against the law which obliges us to promote as much as we can the general good of all men. For my notions had made me see that it is possible to reach understandings which are extremely useful for life, and that instead of the speculative philosophy which is taught in the schools^{vi}, we can find a practical philosophy by which, through understanding the force and actions of fire, air, stars, heavens, and all the other bodies which surround us as distinctly as we understand the various crafts of our artisans, we could use them in the same way for all applications for which they are appropriate and thus make ourselves, as it were, the masters and possessors of nature.

Here Descartes imagines the long-range possibilities of this new scientific method he proposes: controlling nature with machines, developing artificial intelligence, curing diseases, and even halting the ageing process. But these advances won't happen right away, he warns.

But it was not only my desire for the invention of an infinite number of devices which might enable us to enjoy without effort the fruits of the earth and all the commodities found in it, but mainly also my desire for the preservation of our health, which is, without doubt, the principal benefit and the foundation of all the others in this life. For even the mind depends so much on the temperament and the condition of the organs of the body that, if it is possible to find some means to make human beings generally wiser and more skillful than they have been up to this point, I believe we must seek that in medicine. It is true that the medicine now practiced contains few things which are remarkably useful. But without having any design to denigrate it, I am confident that there is no one, not even those who make a living from medicine, who would not claim that everything we know in medicine is almost nothing in comparison to what remains to be known about it and that we could liberate ourselves from an infinity of illnesses, both of the body and the mind, and also perhaps even of the infirmities of ageing, if we had sufficient knowledge of their causes and of all the remedies which nature has provided for us.

For Descartes, mathematical reasoning comes before experimentation

... Besides, I notice that experiments are increasingly necessary as one's knowledge advances, for at the beginning it is better to conduct only those which present themselves to our sense and which we cannot ignore, provided that we engage in a little reflection, than to seek out more rare and original experiments, because these rarer ones are misleading, when we do not yet know the causes of the more common phenomena, and the circumstances on which they depend are almost always so particular and so precise, that it is very difficult to observe them.

His method establishes general principles, and only then considers experimental data

In this work I kept to the following order: first, I tried to find the general principles or the first causes of everything which exists or could exist in the world, without taking into my account of this effect anything other than the fact that God alone created it, not deducing anything additional, other than certain grains of truth which are naturally in our souls. After that, I examined what were the first and most common effects we could deduce from these causes. By doing that, it seems to me, I found the heavens, the stars, and earth, and even on the earth water, air, fire, minerals, and some other things, the sort which are the most common of all and the simplest, and thus the easiest to know.

Then, when I wanted to move down to more particular matters, so many varied ones presented themselves to me that I did not think it would be possible for the human mind to distinguish the forms or species of bodies on the earth from an infinity of others which could exist there if the will of God had put them there and, thus, that one could not adapt them to our use, unless one proceeded to the causes through the effects and that one made use of several particular experiments.

After that, I turned my mind onto all the objects which had ever presented themselves to my senses. I venture to say that I didn't notice in them anything which I could not explain easily enough by the

principles which I had found. But I must also confess that the power of nature is so ample and vast and that its principles are so simple and so general that I observed hardly any particular effect which I did not immediately understand as being capable of being deduced in several different ways, so that my greatest difficulty is usually to find on which of these ways the effect depends. And to resolve this matter, I did not know any other expedient than, once again, to look for some experiments which would be such that their outcomes would not be the same if one of these ways had to explain it rather than some other way.

He asks his readers to conduct all the experiments for which he has neither time nor money

As for the rest, I am now at a point where I perceive well enough, it seems to me, the method one has to use to make most of those experiments which can serve for this purpose. But I also see that they are of such a kind and that there are so many of them that neither my hands nor my income, even if I had a thousand times more of both than I do, could suffice for all of them, so that my progress in understanding nature will be proportional to the means I have for conducting more or fewer experiments. This was what I promised myself I would make known in the treatise which I wrote, as well as showing in it the practical value which the public could gain from these experiments so clearly that I would oblige all those who wished to promote the general well-being of man, that is to say, all those who are truly virtuous and who are not false (by pretending to virtue or merely virtuous by public opinion), to communicate to me all the experiments which they have already made, as well as to help me in researching those which remain to be done.

He doesn't want to publish and become famous because it would distract from his work

. . . if my writings are worth anything, those who have them after my death could use them wherever they were most relevant. But I thought I must not, on any account, agree that they be published during my life, so as to prevent the hostility and controversies which they could perhaps arouse and the sort of reputation which I could acquire from causing me to waste time which I planned to use to instruct myself.

His work may not benefit his contemporaries, but it will be a gift to generations to come

For although it is true that each man is obliged to provide as much as is in him for the good of others and that there is no value whatsoever in anything which has no benefit for anyone, nevertheless it is also true that we should care about things more distant than the present and that it is good to forget about things which might bring some benefit to those now living when one's intention is to create other things which will bring more benefits to our descendants. In fact, I really wanted people to understand that the little I had learned up to this point was almost nothing in comparison with what I was ignorant of and what I did not despair of being able to learn. . .

Most people will be too proud and impatient to use his step-by-step method, preferring the easier route of making assumptions and leaps of faith

But even the best minds have no occasion to want to know these principles. For if they want to know how to speak about everything and to acquire the reputation of being scholarly, they will get there more easily in contenting themselves with probability which can be found in all sorts of matters without great trouble, rather than by seeking out the truth, which is not discovered except little by little in some matters and which, when it is a question of speaking of other matters, requires us to confess frankly that we are ignorant of them. . . .

Ordinary people (who speak and read only French) will be more likely to start from scratch using his method than educated persons (who read Latin, the language of ancient philosophers)

If I write in French, the language of my country, rather than in Latin, the language of my teachers, the reason is that I hope that those who use only their natural reason, pure and simple, will judge my opinions better than those who believe nothing but ancient books. And as for those who combine good sense with study, who are the only ones I hope to have as my judges, I am confident that they will not be so partial to Latin that they will refuse to listen to my reasons because I explain them in the common language.

Translator's and Editor's Notes

This translation from the original French, prepared by Ian Johnston of Malaspina University-College, Nanaimo, BC, Canada, is in the public domain and may be used by anyone, in whole or in part, for any purpose, without permission and without charge, provided the source is acknowledged.

It has been further edited, mainly for length, by David Fenimore of the University of Nevada, Reno, who also composed the headnotes for each part and inserted images with explanatory captions. This latter editor hopes that he has preserved the sense of Descartes's discussion, by modernizing certain words and expressions and deleting many digressions and detailed explanations, without mutilating the original too badly.

Textual Notes

ⁱ *chimera*: a mythological Greek monster.

ⁱⁱ *certain considerations*: one of the considerations preventing the publication of Descartes's great work on physics, *Le Monde*, was the trial in 1633 of Galileo by the Holy Office of the Roman Catholic Church, for the crime of publishing in defense of Copernicus's sun-centered model of the solar system (France was also a Catholic country, albeit at some distance from Rome)

ⁱⁱⁱ *vena arteriosa*: arterial vein.

^{iv} The *English doctor* is William Harvey, who published his pioneering work on the heart and circulation of the blood in 1628 after observing dissections of human cadavers while a student at the University of Padua, Italy (where Galileo had taught mathematics)

^v *someone else*: another reference to Galileo, whose (in 1632) got him into serious difficulties with the church.

^{vi} *the speculative philosophy which is taught in the schools*: i.e., the curriculum based on Aristotle taught in medieval and Early Modern European universities